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U.S. Law of the Sea Cruise to Map the Foot of the Slope and 2500-m Isobath of the Northeast U.S. Atlantic Continental Margin: Legs 4 and 5. Cruise Report

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CRUISE REPORT

USNS *Pathfinder* (T-AGS-60)

U.S. Law of the Sea cruise to map the foot of the slope and 2500-m isobath of the Northeast US Atlantic continental margin: Legs 4 and 5

CRUISES PF05-1 and 2

April 25 to June 30, 2005

Norfolk, VA to Port Canaveral, FL

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Introduction

This is the report of the second-year cruises (Legs 4 and 5) of a two-year, 5 leg, mapping survey of the U.S. Atlantic continental margin. The report of the first-year mapping (Legs 1 through 3) can be found Gardner (2004).

An exhaustive study of the US data holdings pertinent to the formulation of U.S. potential claims under the United Nations Convention of the Law of the Sea (UNCLOS) identified several regions where new bathymetric surveys are needed (Mayer, et al., 2002). The report recommended multibeam echosounder (MBES) data are needed to rigorously define (1) the foot of the slope (FoS), a parameter of a stipulated formula lines, and (2) the 2500-m isobath, a parameter of a stipulated cutoff line. Both of these features, the first a precise geodetic one and second somewhat vague geomorphic one, must be used to define an extended claim. The National Oceanic and Atmospheric Administration (NOAA) was given the charge to contract for the new surveys and they contracted with the Center for Coastal and Ocean Mapping/Joint Hydrographic Center (CCOM/JHC) of the University of New Hampshire to manage the surveys and archive the resultant data. This is the report from the second U.S. Law of the Sea mapping, a detailed MBES survey of the US Atlantic continental margin (Figs.1 and 2).

NOAA entered into an agreement with the US Naval Oceanographic Office (NAVOCEANO) to complete the survey beginning in May 2005. NAVOCEANO made available the 329-ft, 5000-ton hydrographic ship USNS *Pathfinder* (Fig. 3) with a hull-mounted Kongsberg Simrad EM121A MBES as well as an ODEC Bathy2000 3.5-kHz chirp sub-bottom profiler. The planned schedule for the cruise called for 2 legs of ~30 days of operations and one port call. The second leg will not be discussed because the data have been classified by the U.S. Navy.

NAVOCEANO was responsible for system calibration, data collection and quality control and overall cruise management whereas Science Applications International Corp. (SAIC) and Mosaic Hydrographic Services were contracted to perform bathymetry and acoustic-backscatter processing aboard ship. The acoustic backscatter and 3.5-kHz profiler data was the responsibility of Mosaic Hydrographic Services who acted as the UNH/NOAA representative aboard ship.

The first leg of operations (Leg 4) required a half-day transit to an area mapped in 2005 perform a patch test prior to mapping operations. A patch test (exclusive of a yaw calibration) was performed in this area and was followed by 31 days of progressively mapping the margin from the point left off in 2004 towards the south. Leg 4 was completed on May 23, 2005 and the ship transited to Charleston, SC for re-supply and a crew change. Leg 4 collected 6423 line km of MBES and 3.5-kHz profiler lines and mapping a total area of ~77,000 km^2. Leg 5 of the mapping is classified under the U.S. Navy. No information from Leg 5 is available at this time. A summary of the Leg 4 is given in Table 1.

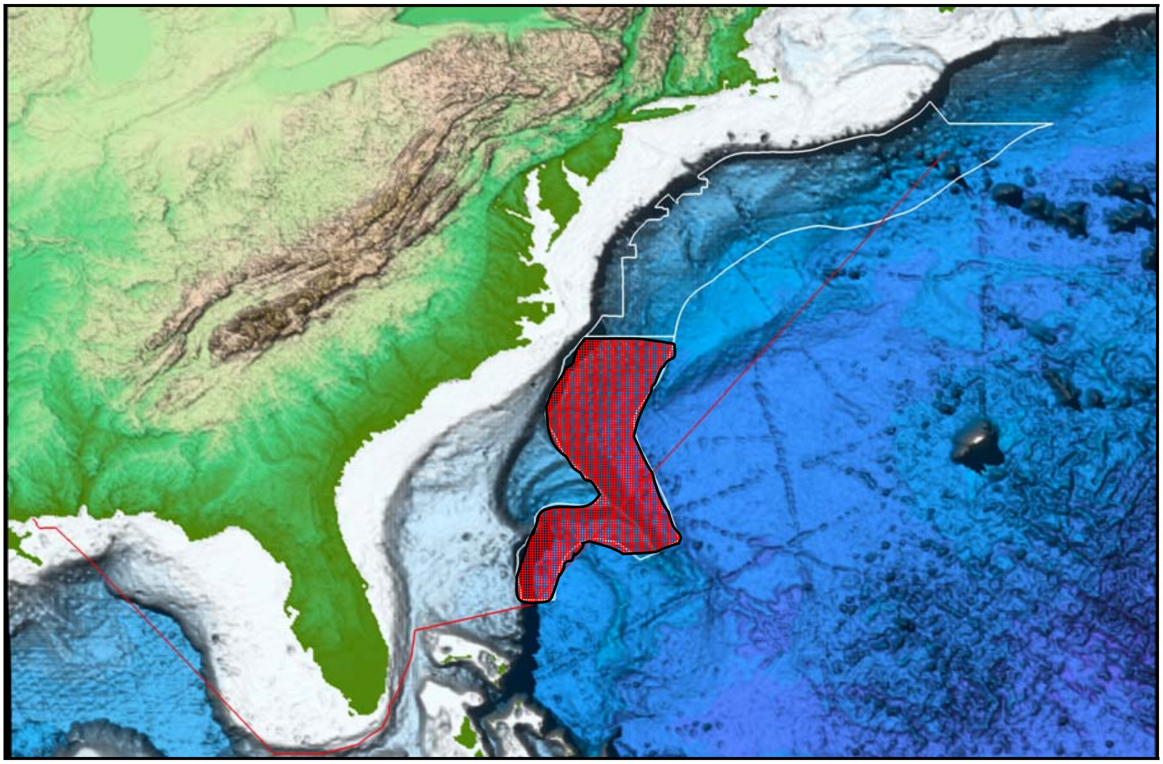


Figure 1a. Areas of 2004 (white outline) and 2005 (red polygon) mapping surveys.

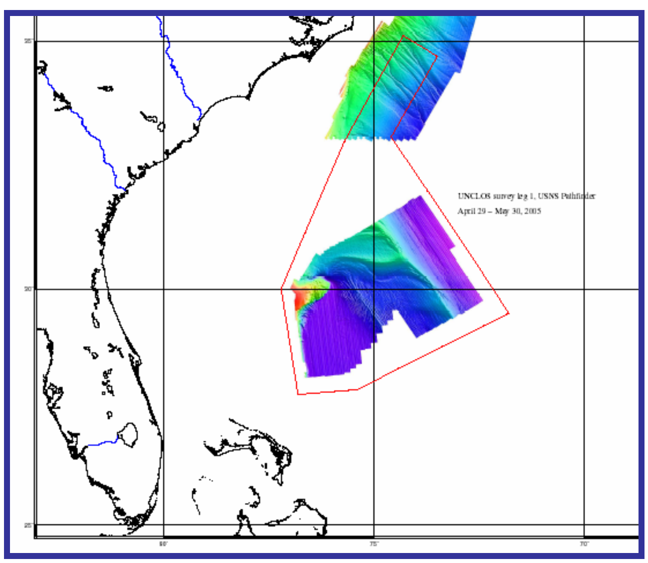


Figure 1b. Area of 2005 mapping.

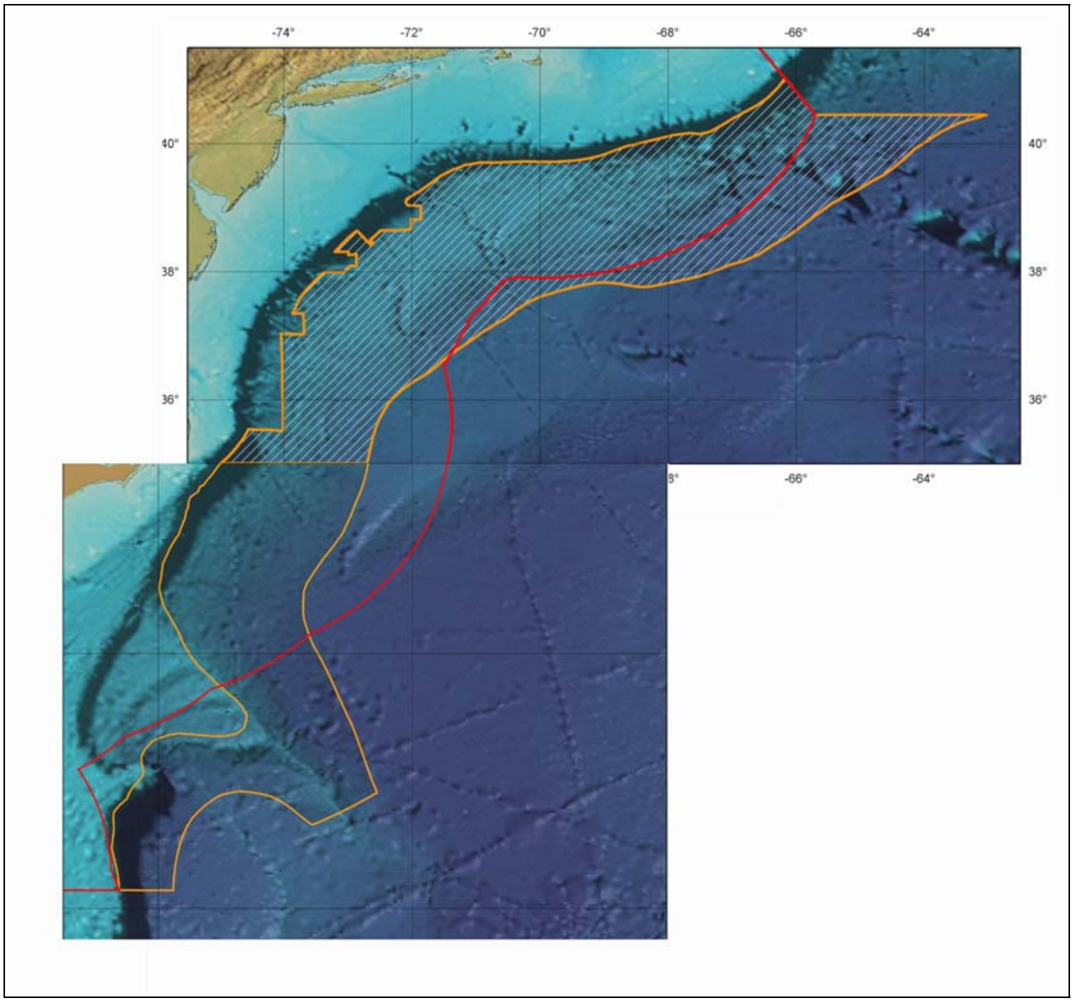


Figure 2. Survey area (orange polygon) of the US Atlantic margin. Red polygon is the limit of the U.S. Exclusive Economic Zone.

Figure 3. USNS *Pathfinder* used to map the U.S. Atlantic margin.

The Multibeam Echosounder and Associated Systems

A hull-mounted Kongsberg Simrad EM121A MBES system was used throughout the survey. The EM121A is a 12-kHz, MBES system that generates 121-1˚ receive apertures over a 120˚ swath. Two Applied Microsystems Ltd Smart SV&T sound-velocity sensors are hull mounted to measure the sound speed at the array for accurate beamforming. Beamforming for the EM121A was in equiangular mode thereby producing seafloor footprints of each receive beam that grow with angle away from nadir. For beams at near-normal incidence, the depth values are determined by center-of-gravity amplitude detection but for most of the beams the depth is determined by interferometric phase detection. Individual mapping spacing was approximately every 50 m, regardless of survey speed.

The manufacturer states that, at the 15-ms pulse length used during this survey (deep mode), the system is capable of depth accuracies of 0.3 to 0.5% of water depth. The motion reference units (MRU) included a Hippy for heave and a Sperry Model Mark 39 gyro for pitch and yaw. The MBES system can incorporate transmit beam steering up to ±10˚ from vertical, roll compensation up to ±10˚ and can perform yaw corrections as well. An Applanix POS/MV 320 version 3 inertial motion unit (IMU) was interfaced with a Wide Area Differential Aided GPS (DGPS) using Fugro SkyFix differential signals to provide position fixes with an accuracy of < ±5 m. All horizontal positions were geo-referenced to the WGS84 ellipsoid and mapping (vertical referencing) was to mean sea level.

The Simrad EM121A is capable of simultaneously collecting full time-series acoustic backscatter along with the bathymetry. The full time-series backscatter is a time series of backscatter values across each beam footprint on the seafloor. If the received amplitudes are properly calibrated to the outgoing signal strength, receiver gains, spherical spreading, and attenuation, then the calibrated backscatter should provide clues as to the composition of the surficial seafloor.

Water-column sound-speed profiles were calculated by two different methods. A CTD (SeaBird model SBE-19) was used to get the full-depth profiles of conductivity and temperature as a function of depth in each survey block (see below). More commonly, Sippican model T-10 (200 m maximum depth) and Deep Blue T-7 (760 m maximum depth) expendable bathythermographs (XBTs) were used to measure temperature as a function of depth routinely every 6 hours and between scheduled casts as required.

The Area: The US Atlantic Margin

The specific area mapped during this cruise was defined in Mayer et al., 2002 as those areas in the North East and South East Atlantic where a potential U.S. claim beyond the US EEZ could be made under UNCLOS Article 76. In order to satisfy the requirements of Article 76, the entire continental slope off the eastern U.S. between the 1000 and 4800-m isobaths needed to be mapped. This area contains numerous large submarine canyons, a chain of volcanic seamounts, major sediment tongues, and a huge sediment drift.

The U.S. eastern margin is a huge constructional prism of sediments and buried reefs that have accumulated over the continent-ocean boundary since the Late Jurassic opening of the Atlantic Ocean (Emery and Uchupi, 1984; Sheridan and Grow, 1988; Poag and Graciansky, 1992). A deep mantle plume or hot-spot erupted off the axis of the nascent spreading ridge in the Early Cretaceous (about 130 m.y. ago). The hot spot produced a string of volcanic seamounts, the New England Seamounts, that continued for ~50 m.y. until the Late Cretaceous (about 73 m.y. ago; Duncan, 1984). The northern part of the survey mapped some of these seamounts. Most of the present geomorphology of the margin is thought to be the result of sedimentation and erosion that occurred during Quaternary (the past 1.8 my.), a period dominated by at least 18 major fluctuations of eustatic sea level (Shackleton, 1987). The age of major canyon cutting is unknown but thought to have occurred during the Neogene and Quaternary.

The southern part of the survey area is dominated by the Blake-Bahama Outer Ridge and Blake Spur (Pratt and Heezen, 1964). These sedimentary features are thought to be related to the formation of the Gulf Stream that resulted from the closing of the Isthmus of Panama during the Late Miocene to Early Pliocene (Kaneps, 1979; Pinet et al., 1981). The barrier diverted the surface waters of the Caribbean and Gulf of Mexico into a anti-cyclonic gyre that merges with the Antilles Current between Florida and the Bahamas and then continues to the NW.

The entire US eastern margin was subdivided into 5 areas for generating overview maps (Fig. 4). Each map was gridded with a 100-m cell size because our 12 to 14 kt mapping speed allowed at least 3 mappings to fall within in each footprint regardless of water depth. Operationally, we were required to subdivide the area into 9 NAVO Areas (Fig. 5). Individual lines were required to stay within each NAVO Area during the mapping, so that the mapping progressed from one area to another. The NAVO Areas are not to be confused with the overview areas. The maps in Appendix 3 of this report are of the overview areas.

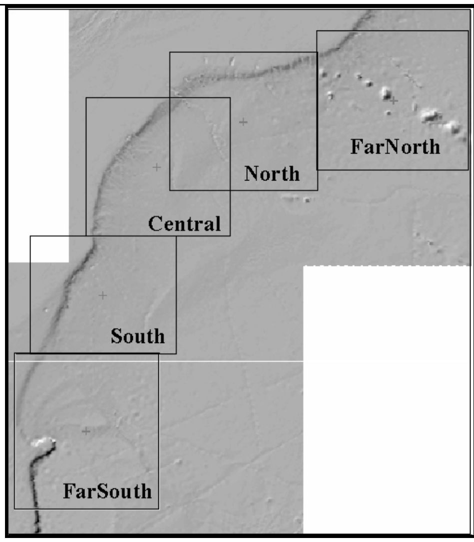
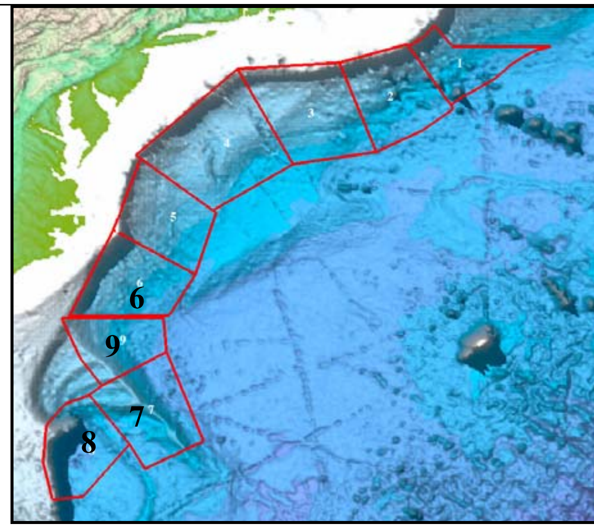
	

Figure 4. Index of map areas. 2005 mapping concentrated in South and FarSouth blocks	Figure 5. Index of NAVO areas used for operations only. 2005 mapping concentrated in areas 6, 7, 8, and 9.

Daily Log Leg 4

April 29, 2005 (JD 119)

We departed Norfolk Little Creek Amphibious base at 1600 L and transited to the patch test in Area 6

April 30th 2005 (JD 120)

We arrived at the patch test area 1200 L. CTD and XBT casts were completed by 1300 L. The patch test was conducted over channel and flat area over previously surveyed seafloor in area 6.

Patch test was successfully completed and analyzed checked by NAVO, SAIC and NOAA representative.

May 1, 2005 (JD 121)

The patch test was completed at 0800 L. We encountered issues with the ISS60 software and line running. A roll offset of 9999° was input into the system. A dip line was run to the north; however, the sea state was too rough. We then turned on to SW survey line but could only survey at 5-6 kts with questionable data quality because of 40 knots winds and a 3-m sea/

An anomaly in the data was discovered (Fig. 6a) that appears to correlate with a bad amplifier on channel 41 on the EM121 array (Fig. 6b).

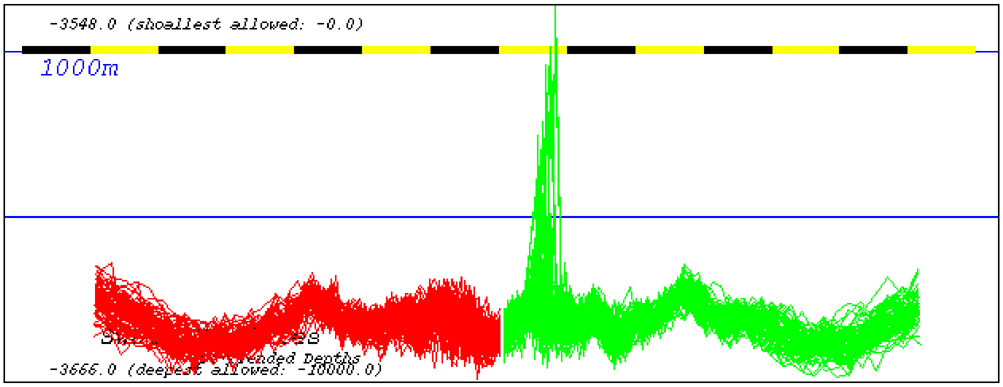


Figure 6a. Anomaly in data that corresponds to bad channel in Simrad EM121A

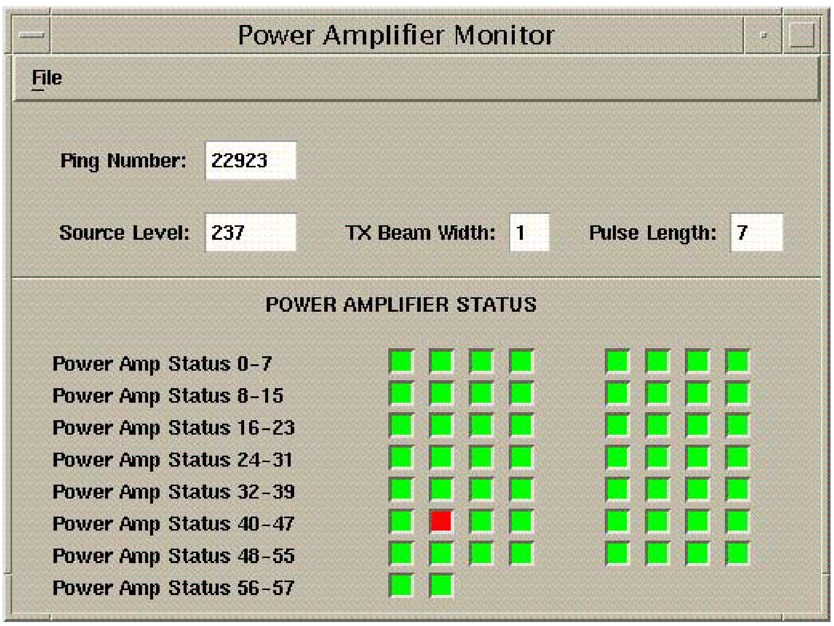


Figure 6b. Channel 41 indicates fault in power amplifier of Simrad EM121A

May 2, 2005 (JD122)

The sea conditions improved and we were able to survey at 12 kts with good data quality. The DGPS started at 1400 UTC. Using the cross-check analysis tool, the dipline passed the IHO Order 1 test (Fig.7).

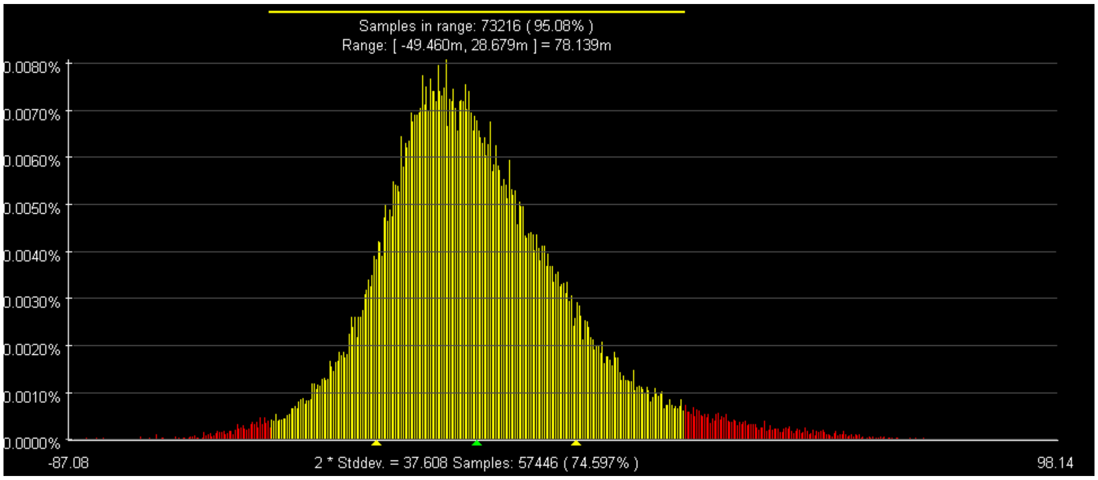
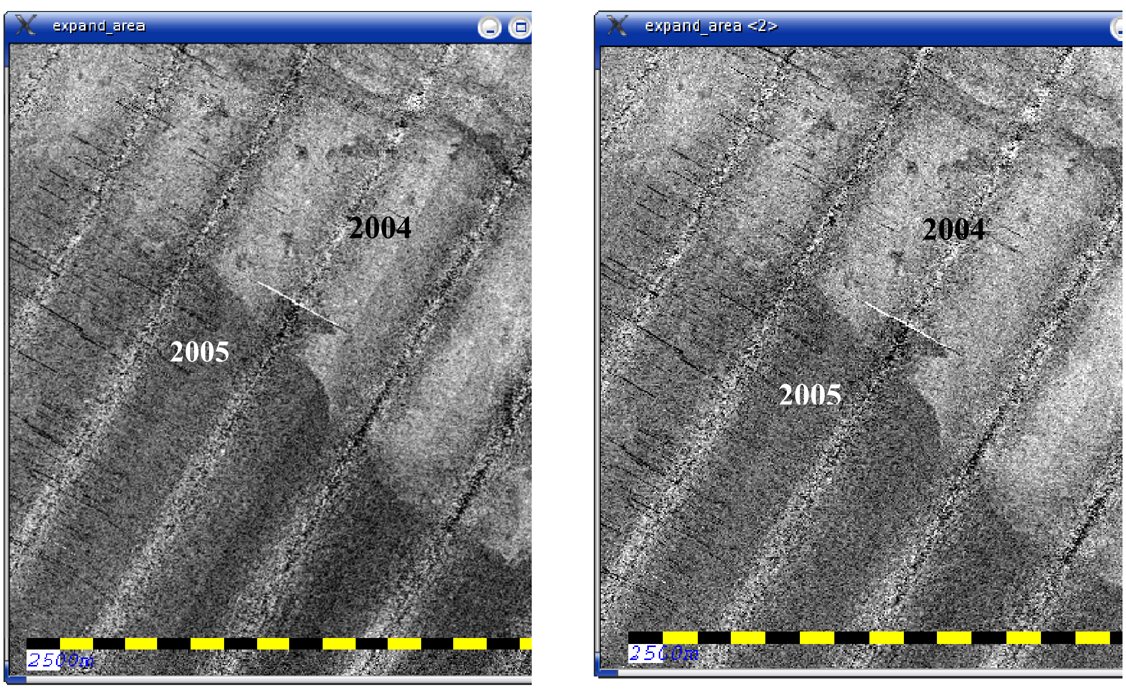


Figure 7. Cross-check analysis of first dip line.

The Pathfinder backscatter data showed a subtle shift when compared to the 2004 Henson data (Fig. 8). The 2004 Henson values were used as reference with a -1.5 dB shift applied to all Pathfinder data.



Before correction After correction

Figure 8. Correction for backscatter offset between 2004 Henson survey and 2005 Pathfinder survey.

May 3, 2005 (JD 123)

Routine day of mapping in Area 6. Good sea conditions and we were able to map at 13 kts.

May 4, 2005 (JD 124)

Routine day of mapping in Area 6. The ship was stopped at 1200 L to investigate a life ring and flotsam and jetsam. The wind began rising to 30 to 40 kts in the afternoon.

May 5, 2005 (JD 125)

Routine day of mapping in Area 6.

May 6, 2005 (JD 126)

We were unable to complete the planned survey lines because of U.S. Navy operations. While waiting, we ran an extended dip line to the NE. We finished the dipline in the morning and had to hove-to for the remainder of the day because of foul weather.

May 7, 2005 (JD 127)

We were hove-to all morning because of weather. We drifted 70 miles to SW while waiting for the weather to clear. We headed back towards the survey line at 1200 L, but bucking rough weather.

May 8, 2005 (JD 128)

Weather conditions improved and we were able to resume mapping. Logging started at 0700 L. The last line in Area 6 was completed and we remapped line 269 while transiting to Area 7. Aggressive use of XBT casts (Fig. 9) resulted in very good management of refraction issues with no data "steps" seen because of profile changes.

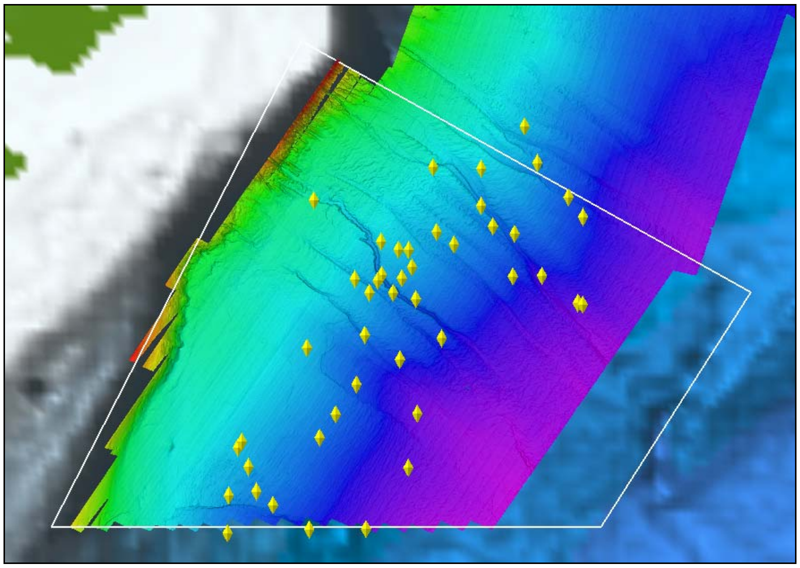


Figure 9. Location of XBT casts in Area 6

May 9, 2005 (JD 129)

Calm weather returned and we transited to area 7. Surface sound speed of the XBT and surface SV sensor disagreed so we switched out SVP sensor. The problem was broken ground strap on XBT launcher. Commenced mapping in area 7 at 1200 L. New problems cropped up with the installed SVP sensor but when the original sensor was replaced the problems disappeared.

May 10, 2005 (JD 130)

We continued mapping in area 7. Problems encountered with OMG software corrupting heading when passing through 327 degrees. OMG has been notified, solution is required due to heading of lines in area 7.

May 11, 2005 (JD 131)

Mapped along the west side of area 7 under excellent conditions. Because of issues with surveying in the U.S. Navy Restricted Area, we were unable to completely map the 2500-m isobath in this area (Fig. 10).

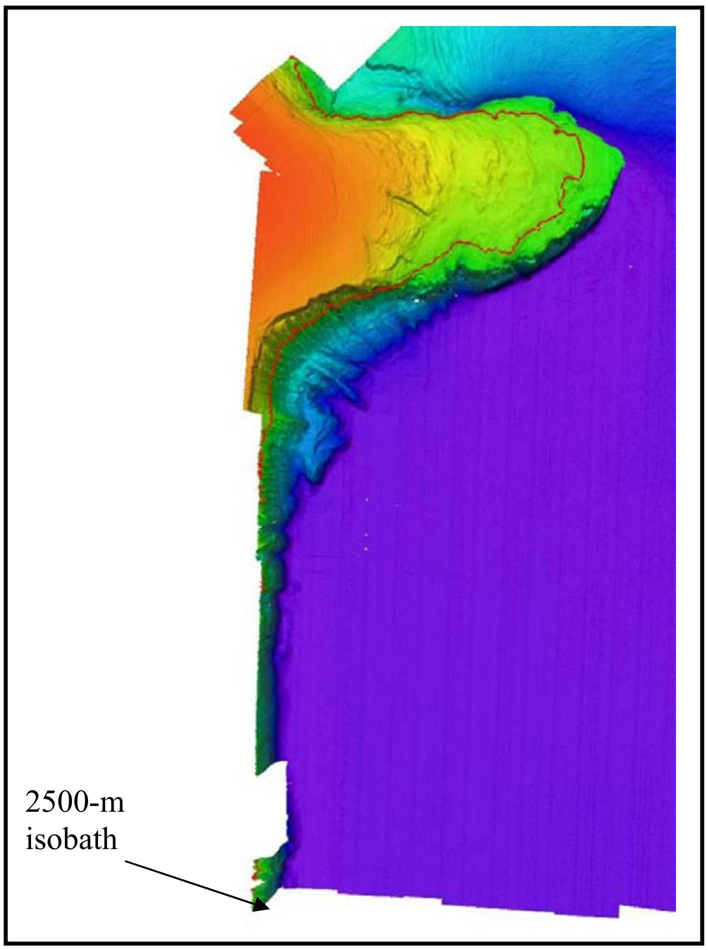


Figure 10. The 2500-m isobath on western edge of Area 7

May 12, 2005 (JD 132)

The day was spent mapping the Blake Spur in area 7. A dip line was run to the Eastern corner of Area 7 in order to complete short lines during ideal weather conditions.

May 13, 2005 (JD 133)

Routine day of mapping N-S lines in area 7, working towards the east. Excellent conditions

May 14, 2005 (JD 134)

Routine day of mapping N-S lines in area 7, working towards the east. Excellent conditions

May 15, 2005 (JD 135)

Routine day of mapping N-S lines in area 7, working towards the east. Excellent conditions

May 16, 2005 (JD 136)

Routine day of mapping N-S lines in area 7, working towards the east. Excellent conditions

May 17, 2005 (JD 137)

Routine day of mapping N-S lines in area 7, working towards the east. Excellent conditions

May 18, 2005 (JD 138)

We spent the day mapping a few small holidays over Blake Spur and then completed the mapping of area 7.

May 19, 2005 (JD 139)

A dip line was run from west to east through Area 8 and then we commenced mapping the seaward edge of Area 8. It was determined that it was not necessary to map out to the eastern extent of Area 8 because the foot of the slope had already been clearly defined.

May 20, 2005 (JD 140)

Routine day of mapping in area 8. The seas increased throughout he day but conditions were still good for mapping. The increased sea state restricted our speed to 12 kts. The POS/MV lost position in middle of Line 333, so the logging was stopped and the POS/MV was restarted. The first line on eastern edge of Area 8 did not acquire logged raw EM121A data but the bathymetry data are available from the GSF file. The only loss was the acoustic-backscatter data for this line.

May 21, 2005 (JD 141)

Routine mapping north-south lines in area 8

May 22, 2005 (JD 142)

Routine mapping north-south lines in area 8

May 23, 2005 (JD 143)

Routine mapping north-south lines in area 8

May 24, 2005 (JD 144)

Routine mapping north-south lines in area 8

May 25, 2005 (JD 145)

Routine mapping north-south lines in area 8

May 26, 2005 (JD 146)

Routine mapping north-south lines in area 8

May 27, 2005 (JD 147)

We finished the mapping of Area 8 and started filling holidays in northern section of area 7.

May 28, 2005 (JD 148)

Mapped holidays in area 7. Figure 11 shows a map of the XBTs from areas 7 and 8.

May 29, 2005 (JD 149)

Mapped holidays in area 7 and then moved to the contingency area over Blake Spur.

May 30, 2005 (JD 150)

Mapped in area 7. It was discovered that the EM121A mode mysteriously had been switched to "Auto", which resulted in 6 of the last 7 lines being mapped in the "Intermediate" mode. This mode uses a shorter pulse length that introduces artifacts in deep-water areas. The last line was completed at 0815 L and we began the transit to Charleston.

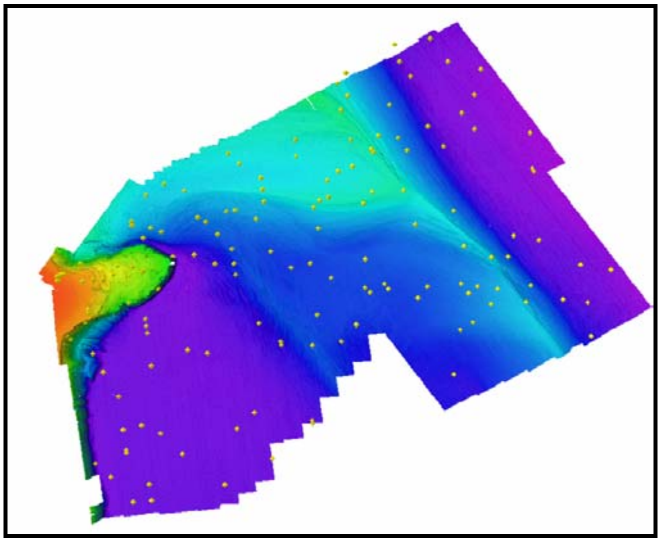


Figure11. Location of XBT casts in Areas 7 and 8

May 31, 2005 (JD 151)

Leg 1 ended when we docked in Charleston, SC at 1130 L.

Leg 5

The entire Leg 5 operations are classified by the U.S. Navy. The mapping was conducted without any UNH/NOAA or SAIC representatives aboard. All data collected on Leg 2. No information on this cruise is available at this time.

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Table 1. Cruise Statistics (excluding transits) of data collection

Leg	JD dates	Line miles (nm)
4	120 to 150	11,895
5		
Total		

Table 2. Conversion table of NAVO raw.all file names to UNH and SAIC file names by Julian Day

JD	Data Folder	NAVO file name _raw.all	UNH file name _raw.all	SAIC GSF file name
120	**050430**	**0002_300405_215502**	**Atlantic_line_patch_6**	**60mba05120_u_500p.d02**
120	050430	0003_300405_222919	Atlantic_line_patch_7	60mba05120_u_500p.d03
121	**050501**	**0002_010505_004936**	**Atlantic_line_patch_8**	**60mba05121_u_500p.d02**
121	050501	0004_010505_014853	Atlantic_line_patch_9	60mba05121_u_500p.d04
121	050501	0007_010505_041532	Atlantic_line_patch_10	60mba05121_u_500p.d07
121	050501	0012_010505_090748	Atlantic_line_patch_11	60mba05121_u_500p.d12
121	050501	0013_010505_100507	Atlantic_line_patch_12	60mba05121_u_500p.d13
121	050501	0014_010505_110127	Atlantic_line_patch_13	60mba05121_u_500p.d14

JD	Data Folder	NAVO file name _raw.all	UNH file name _raw.all	SAIC GSF file name
121	050501	0015_010505_115920	Atlantic_line_268(dip (dipline)	60mba05121_u_500p.d15
121	050501	0016_010505_130553	Atlantic_line_269	60mba05121_u_500p.d16
122	**050502**	**0017_020505_064533**	**Atlantic_line_270**	**60mba05122_u_500p.d01**
122	050502	0018_020505_144629	Atlantic_line_271 (DGPS started)	60mba05122_u_500p.d02
122	050502	0019_020505_195848	Atlantic_line_272	60mba05122_u_500p.d04 60mba05122_u_500p.d05
123	**050503**	**0020_030505_075029**	**Atlantic_line_273**	**60mba05123_u_500p.d01**
123	050503	0021_030505_200904	Atlantic_line_274	60mba05123_u_500p.d02 60mba05123_u_500p.d03
124	**050504**	**0022_040505_013103**	**Atlantic_line_275**	**60mba05124_u_500p.d01**
124	050504	0023_040505_062450	Atlantic_line_276	60mba05124_u_500p.d02
124	050504	0023_040505_154614	Atlantic_line_277	60mba05124_u_500p.d02
124	050504	0024_050505_185033	Atlantic_line_278	60mba05124_u_500p.d03
125	**050505**	**0025_050505_000012**	**Atlantic_line_279**	**60mba05125_u_500p.d01**
125	050505	0026_050505_022637	Atlantic_line_280	60mba05125_u_500p.d02
125	050505	0027_050505_101813	Atlantic_line_281	60mba05125_u_500p.d03
125	050505	0028_050505_212245	Atlantic_line_282	60mba05125_u_500p.d04
126	**050506**	**0029_060505_001113**	**Atlantic_line_283**	**60mba05126_u_500p.d01**
126	050506	0029_060505_010210	Atlantic_line_284 dipline	60mba05126_u_500p.d02
128	**050508**	**0031_080505_102005**	**Atlantic_line_285**	**60mba05128_u_500p.d01**
128	050508	0032_080505_165205	Atlantic_line_286	60mba05128_u_500p.d02
128	050508	0033_080505_204050	Atlantic_line_287	60mba05128_u_500p.d03 60mba05129_u_500p.d01
129	**050509**	**0035_090505_032629**	**Atlantic_line_288**	**60mba05129_u_500p.d02**
129	050509	0036_090505_220803	Atlantic_line_289	60mba05129_u_500p.d03
130	**050510**	**0038_100505_034053**	**Atlantic_line_290** 5 dn shift	**60mba05130_u_500p.d02**
130	050510	0039_100505_104832	Atlantic_line_291	60mba05130_u_500p.d03
130	050510	0040_100505_223503	Atlantic_line_292	60mba05130_u_500p.d04
131	**050511**	**0041_110505_001152**	**Atlantic_line_293** 10 dn shift	**60mba05131_u_500p.d01**
131	050511	0042_110505_034434	Atlantic_line_294	60mba05131_u_500p.d02
131	050511	0042_110505_072703	Atlantic_line_295	60mba05131_u_500p.d02
131	050511	0043_110505_095857	Atlantic_line_296	60mba05131_u_500p.d04
131	050511	0044_110505_2243241	Atlantic_line_297	60mba05131_u_500p.d05
131	050511	0044_110505_224911	Atlantic_line_298	60mba05131_u_500p.d05
132	**050512**	**0045_120505_000015**	**Atlantic_line_299**	**60mba05132_u_500p.d01**
JD	**Data**	**NAVO file name**	**UNH file name**	**SAIC**

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132	050512	0047_120505_051146	Atlantic_line_301	60mba05132_u_500p.d03
132	050512	0048_120505_070539	Atlantic_line_302	60mba05132_u_500p.d04
132	050512	0049_120505_091354	Atlantic_line_303	60mba05132_u_500p.d05
132	050512	0050_120505_094529	Atlantic_line_304 dipline	60mba05132_u_500p.d06
132	050512	0051_120505_194747	Atlantic_line_305	60mba05132_u_500p.d07
132	050512	0052_120505_221508	Atlantic_line_306	60mba05132_u_500p.d08
133	**050513**	**0053_130505_000005**	**Atlantic_line_307**	**60mba05133_u_500p.d01**
133	050513	0054_130505_022900	Atlantic_line_308	60mba05133_u_500p.d02
133	050513	0055_130505_093047	Atlantic_line_309	60mba05133_u_500p.d03
133	050513	0056_130505_181204	Atlantic_line_310	60mba05133_u_500p.d04
134	**050514**	**0057_140505_000013**	**Atlantic_line_311**	**60mba05134_u_500p.d01**
134	050514	0058_140505_045752	Atlantic_line_312	60mba05134_u_500p.d02
134	050514	0059_140505_173924	Atlantic_line_313 Delete start of line (turn)	60mba05134_u_500p.d03
135	**050515**	**0060_150505_000709**	**Atlantic_line_314**	**60mba05135_u_500p.d01**
135	050515	0061_150505_075542	Atlantic_line_315	60mba05135_u_500p.d02
135	050515	0062_150505_213920	Atlantic_line_316	60mba05135_u_500p.d03
136	**050516**	**0063_160505_000018**	**Atlantic_line_317**	**60mba05136_u_500p.d01**
136	050516	0064_160505_105518	Atlantic_line_318	60mba05136_u_500p.d02
137	**050517**	**0065_170505_001702**	**Atlantic_line_319**	**60mba05137_u_500p.d01**
137	050517	0066_170505_133211	Atlantic_line_320	60mba05137_u_500p.d02
138	**050518**	**0067_180505_000012**	**Atlantic_line_321**	**60mba05138_u_500p.d01**
138	050518	0068_180505_025730	Atlantic_line_322	60mba05138_u_500p.d02
138	050518	0069_180505_143910	Atlantic_line_323	60mba05138_u_500p.d03
138	050518	0070_180505_180210	Atlantic_line_324	60mba05138_u_500p.d04
138	050518	0071_180505_225142	Atlantic_line_325	60mba05138_u_500p.d05
139	**050519**	**0072_190505_000442**	**Atlantic_line_326**	**60mba05139_u_500p.d01**
139	050519	0073_190505_023035	Atlantic_line_327	60mba05139_u_500p.d02
139	050519	0074_190505_051937	Atlantic_line_328	60mba05139_u_500p.d03
139	050519	0075_190505_100723	Atlantic_line_329	60mba05139_u_500p.d04
139	050519	0076_190505_132631	Atlantic_line_330	60mba05139_u_500p.d05
139	050519	0077_190505_200511	Atlantic_line_331 dipline	60mba05139_u_500p.d06
140	**050520**		**raw.all file not logged**	**60mba05140_u_500p.d02**
140	050520	0080_200505_121643	Atlantic_line_333	60mba05140_u_500p.d03
140	050520	0080_200505_203807	Atlantic_line_334	60mba05140_u_500p.d03
141	**050521**	**0081_210505_000056**	**Atlantic_line_335**	**60mba05141_u_500p.d01**
141	050521	0082_210505_033647	Atlantic_line_336	60mba05141_u_500p.d02
141	050521	0083_210505_165637	Atlantic_line_337	60mba05141_u_500p.d03
JD	**Data Folder**	**NAVO file name _raw.all**	**UNH file name _raw.all**	**SAIC GSF file name**

142	**050522**	**0084_220505_000313**	**Atlantic_line_338**	**60mba05142_u_500p.d01**
142	050522	0085_220505_042802	Atlantic_line_339	60mba05142_u_500p.d02
142	050522	0086_220505_163941	Atlantic_line_340	60mba05142_u_500p.d03
143	**050523**	**0087_230505_000**	**Atlantic_line_341**	**60mba05143_u_500p.d01**
143	050523	0088_230505_040529	Atlantic_line_342	60mba05143_u_500p.d02
143	050523	0089_230505_160039	Atlantic_line_343	60mba05143_u_500p.d03
144	**050524**	**0090_240505_000015**	**Atlantic_line_344**	**60mba05144_u_500p.d01**
144	050524	0091_240505_034534	Atlantic_line_345	60mba05144_u_500p.d02
144	050524	0092_240505_160809	Atlantic_line_346	60mba05144_u_500p.d03
145	**050525**	**0093_250505_000030**	**Atlantic_line_347**	**60mba05145_u_500p.d01**
145	050525	0094_250505_040319	Atlantic_line_348	60mba05145_u_500p.d02
145	050525	0095_250505_153917	Atlantic_line_349	60mba05145_u_500p.d03
146	**050526**	**0096_260505_000007**	**Atlantic_line_350**	**60mba05146_u_500p.d01**
146	050526	0097_260505_024509	Atlantic_line_351	60mba05146_u_500p.d02
146	050526	0098_260505_141224	Atlantic_line_352	60mba05146_u_500p.d03
147	**050527**	**0099_270505_000006**	**Atlantic_line_353**	**60mba05147_u_500p.d01**
147	050527	0100_270505_014029	Atlantic_line_354	60mba05147_u_500p.d02
147	050527	0101_270505_071508	Atlantic_line_355	60mba05147_u_500p.d03
147	050527	0102_270505_092044	Atlantic_line_356	60mba05147_u_500p.d04
147	050527	0103_270505_142217	Atlantic_line_357	60mba05147_u_500p.d05
147	050527	0104_270505_205548	Atlantic_line_358	60mba05147_u_500p.d06
147	050527	0105_270505_233612	Atlantic_line_359	60mba05147_u_500p.d07
148	**050528**	**0106_280505_000008**	**Atlantic_line_360**	**60mba05148_u_500p.d01**
148	050528	0107_280505_032422	Atlantic_line_361	60mba05148_u_500p.d02
148	050528	0108_280505_062510	Atlantic_line_362	60mba05148_u_500p.d03
148	050528	0109_280505_091351	Atlantic_line_363	60mba05148_u_500p.d04
148	050528	0110_280505_115750	Atlantic_line_364	60mba05148_u_500p.d05
148	050528	0111_280505_142210	Atlantic_line_365	60mba05148_u_500p.d06
148	050528	0112_280505_194912	Atlantic_line_366	60mba05148_u_500p.d07
148	050528	0113_280505_232142	Atlantic_line_367	60mba05148_u_500p.d08
148	050528	0114_280505_235823	Atlantic_line_368	60mba05148_u_500p.d09
149	**050529**	**0114_290505_003530**	**Atlantic_line_369**	**60mba05149_u_500p.d01**
149	050529	0115_290505_030936	Atlantic_line_370	60mba05149_u_500p.d02
149	050529	0116_290505_053611	Atlantic_line_371	60mba05149_u_500p.d03
149	050529	0117_290505_061658	Atlantic_line_372	60mba05149_u_500p.d04
149	050529	0118_290505_083753	Atlantic_line_373	60mba05149_u_500p.d05
149	050529	0119_290505_110024	Atlantic_line_374	60mba05149_u_500p.d06
149	050529	0120_290505_132023	Atlantic_line_375	60mba05149_u_500p.d07
149	050529	0121_290505_152319	Atlantic_line_376	60mba05149_u_500p.d08
149	050529	0122_290505_174108	Atlantic_line_377	60mba05149_u_500p.d09
149	050529	0123_290505_192611	Atlantic_line_378	60mba05149_u_500p.d10
149	050529	0124_290505_205218	Atlantic_line_379	60mba05149_u_500p.d11
150	**050530**	**0125_300505_005215**	**Atlantic_line_380***	**60mba05150_u_500p.d01**
JD	**Data Folder**	**NAVO file name _raw.all**	**UNH file name _raw.all**	**SAIC GSF file name**
150	050530	0126_300505_055516	Atlantic_line_381	60mba05150_u_500p.d02

150	050530	0127_300505_065947	Atlantic_line_382*	60mba05150_u_500p.d03
150	050530	0128_300505_072711	Atlantic_line_383*	60mba05150_u_500p.d04
150	050530	0129_300505_083620	Atlantic_line_384*	60mba05150_u_500p.d05
150	050530	0130_300505_095333	Atlantic_line_385*	60mba05150_u_500p.d06
150	050530	0131_300505_113031	Atlantic_line_386*	60mba05150_u_500p.d07
			***lines logged in auto mode**	

Appendix 1. Cruise Calendar

April 2005

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					JD119 29 depart Little Creek, VA 1600 L	JD120 30 patch test

May 2005

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
JD121 1 started dip line-stopped by weather	JD122 2 began mapping area 6	JD123 3 mapping area 6	JD124 4 mapping area 6	JD125 5 mapping area 6	JD126 6 Navy ops no mapping	JD127 7 weather hove-to
JD128 8 completed area 6	JD129 9 started mapping area7	JD130 10 mapping area7	JD131 11 mapping area7	JD132 12 mapping area7	JD133 13 mapping area7	JD134 14 mapping area7
JD135 15 mapping area7	JD136 16 mapping area7	JD137 17 mapping area7	JD138 18 mapping area7	JD139 19 dip line area8	JD140 20 mapping area8	JD141 21 mapping area8
JD142 22 mapping area8	JD143 23 mapping area8	JD144 24 mapping area8	JD145 25 mapping area8	JD146 26 dip line area8	JD147 27 mapping area7	JD148 28 mapping area7
JD149 29 finished mapping area8	JD150 30 finished mapping area7	JD151 31 arrived Charleston, SC 1130L				

JUNE 2005

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			JD152 1 port call	JD153 2 port call	JD154 3 port call	JD155 4 port call
JD156 5 mapping US Navy restricted area	JD157 6 mapping US Navy restricted area	JD158 7 mapping US Navy restricted area	JD159 8 mapping US Navy restricted area	JD160 9 mapping US Navy restricted area	JD161 10 mapping US Navy restricted area	JD162 11 mapping US Navy restricted area
JD163 12 mapping US Navy restricted area	JD164 13 mapping US Navy restricted area	JD165 14 mapping US Navy restricted area	JD166 15 mapping US Navy restricted area	JD167 16 mapping US Navy restricted area	JD168 17 mapping US Navy restricted area	JD169 18 mapping US Navy restricted area
JD170 19 mapping US Navy restricted area	JD171 20 mapping US Navy restricted area	JD172 21 mapping US Navy restricted area	JD173 22 mapping US Navy restricted area	JD174 23 mapping US Navy restricted area	JD175 24 mapping US Navy restricted area	JD176 25 Arrive Port Canaveral, FL

Appendix 2. Cruise Personnel

Name	Position	Legs
Doug Cartwright, MosaicHydro	UNH/NOAA rep	4
Jason Infantino, SAIC	bathymetry processing	4
Wayne Owen, NAVO	SNR	4
Gordon Marsh, NAVO	SNR	4 & 5
Shirley Dorsey, NAVO	Data Manager	4 & 5
Kelly Fougerousse, NAVO	MBES tech	4 & 5
Mike Fougerousse, NAVO	MBES tech	4 & 5
Lucretia Lenoir, NAVO	Watchstander	4 & 5
Capt. Troy Irwin, Horizon Lines	Master	4 & 5

Appendix 3. Color shaded-relief bathymetry and acoustic backscatter maps of southern region of U.S. Atlantic continental margin.

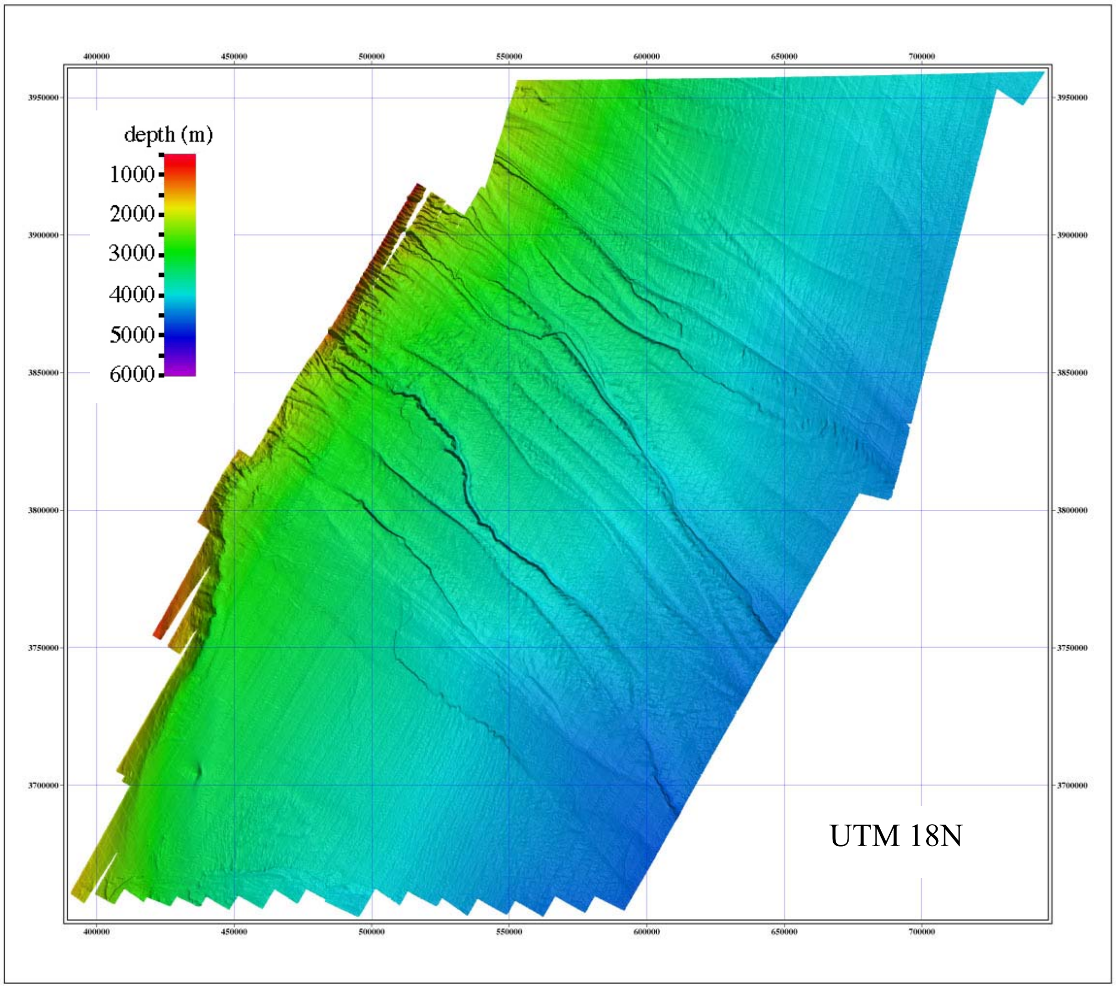

Figure 12. Color-coded shaded relief map of South bathymetry.

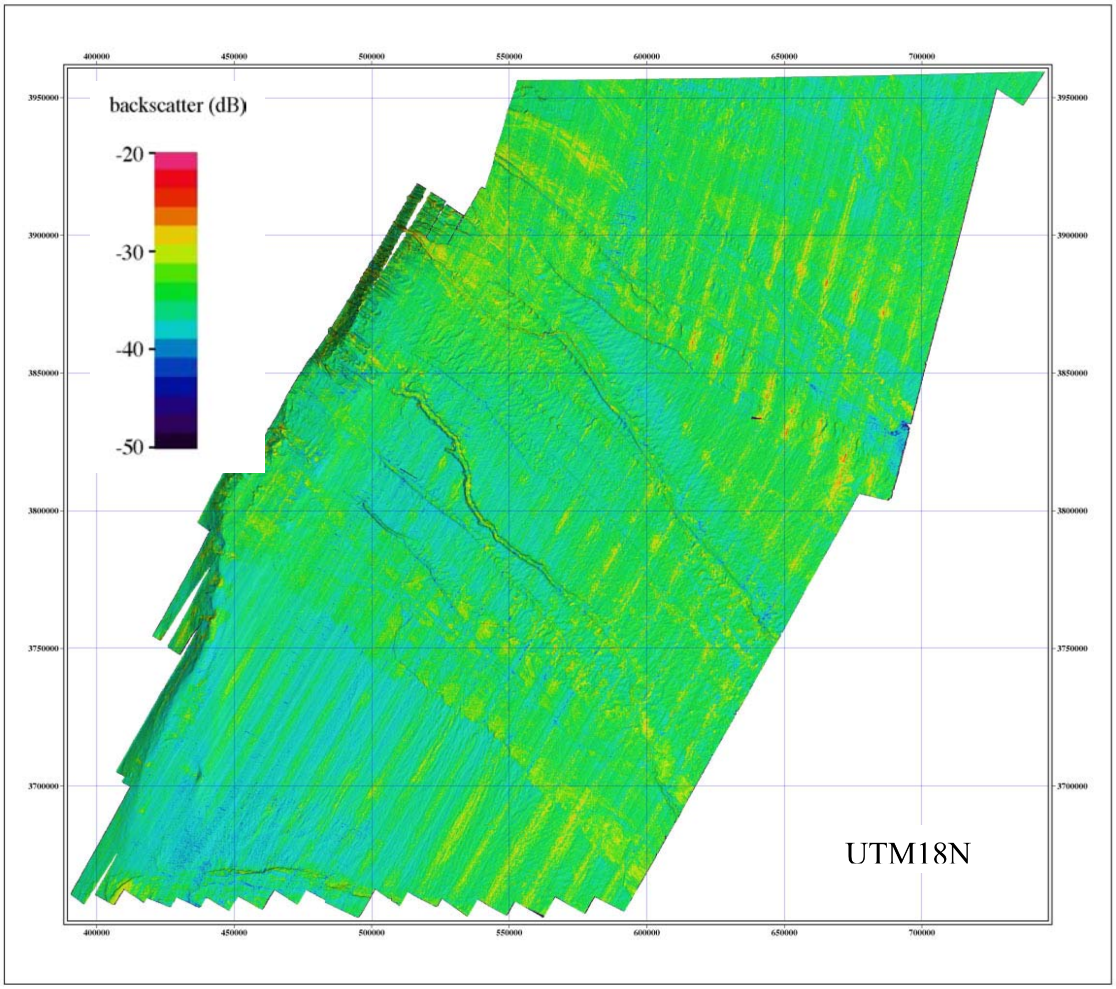

Figure 13. Acoustic backscatter map of South area.

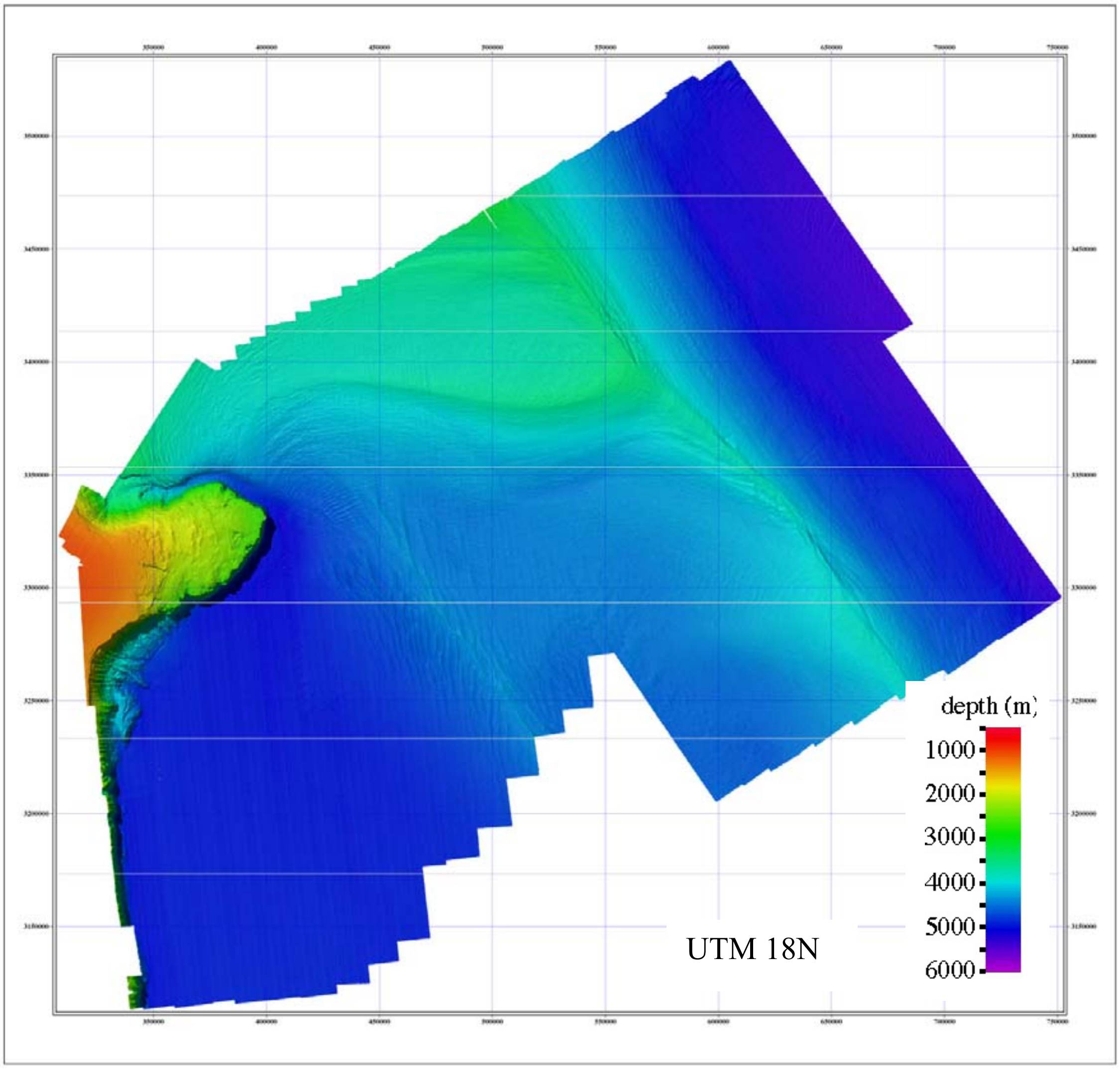

Figure 14. Color-coded shaded relief of FarSouth bathymetry.

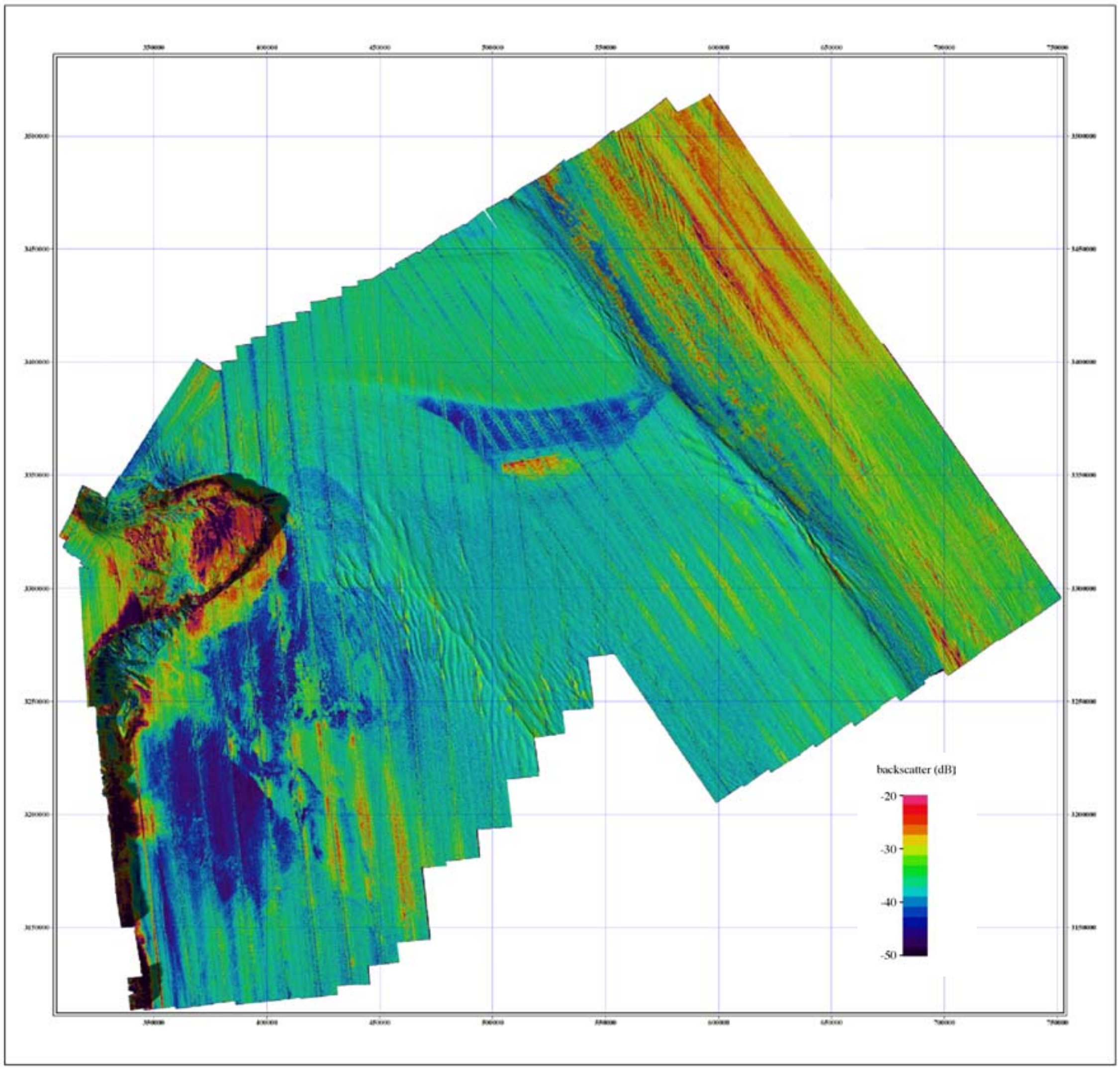

Figure 15. Acoustic backscatter map of FarSouth area.